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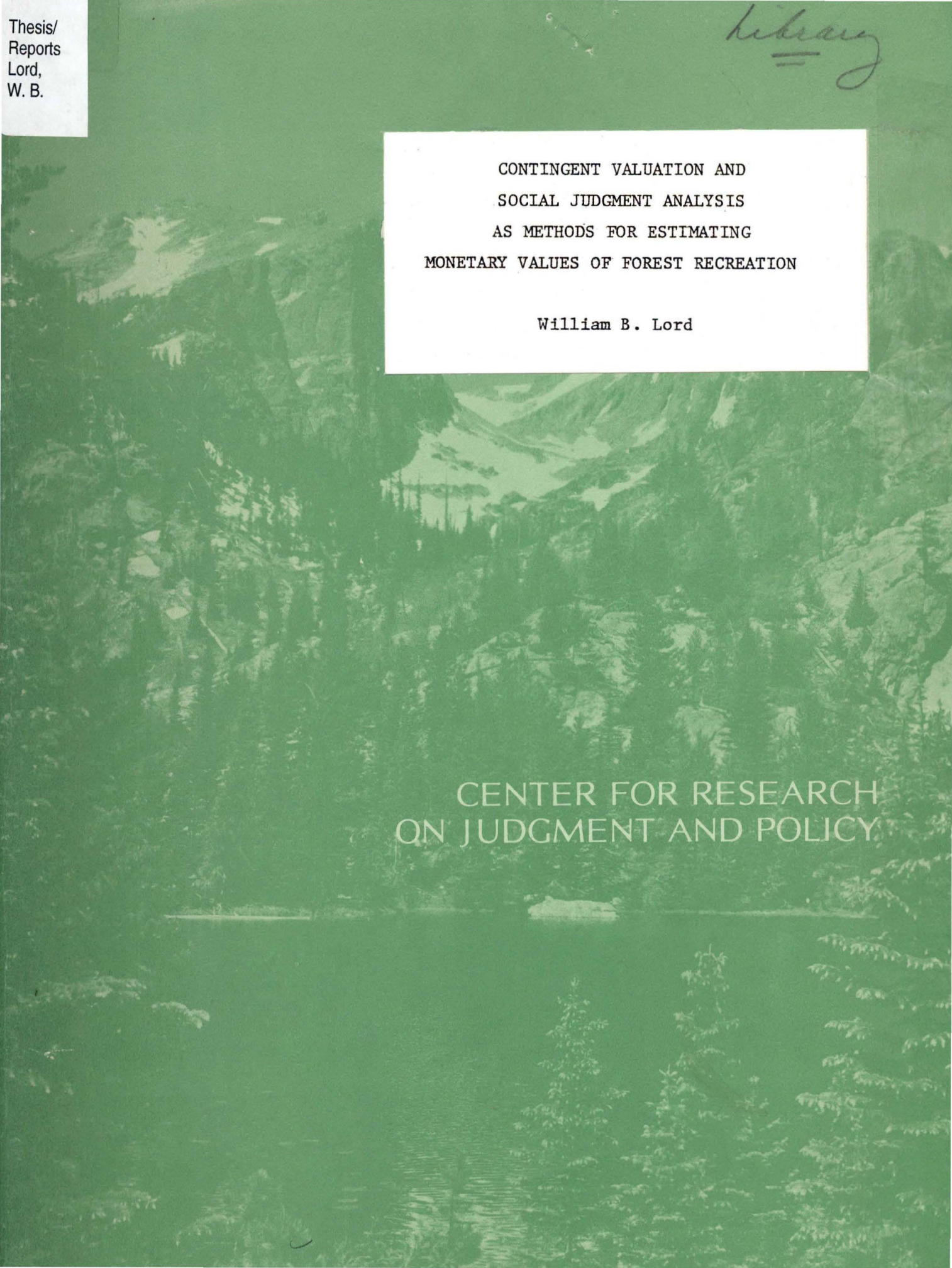

CENTER FOR RESEARCH
ON JUDGMENT AND POLICY

CONTINGENT VALUATION AND SOCIAL JUDGMENT ANALYSIS AS METHODS FOR ESTIMATING MONETARY VALUES OF FOREST RECREATION

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CONTINGENT VALUATION AND SOCIAL JUDGMENT ANALYSIS AS METHODS FOR ESTIMATING MONETARY VALUES OF FOREST RECREATION

Introduction

Forest planners and managers have long confronted the need to make explicit trade-offs between priced and unpriced forest outputs. Joint production decisions involving marketed outputs, such as timber and forage, and non-marketed outputs, such as watershed protection and wildlife, require knowledge of both the supply-side interdependencies between such forest outputs and their demand-side values. Identifying the optimal combination of interdependent outputs to produce is straightforward only when all output values are commensurate. They are not commensurate when the index of value is a monetary one in some cases but not in others. Analysts or decision makers are then motivated to find a common unit of value measure in order to make explicit trade-off analyses possible. The most obvious such measure is the monetary one, and the search for methods of assigning monetary values to nonmarketed or, more generally, unpriced outputs has been a prominent research concern for many years.

Recent legislation has elevated this long-standing concern to even greater prominence within the U.S. Forest Service. Both the Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 and the National Forest Management Act (NMFA) of 1976 require the Forest Service to make explicit trade-offs between priced and unpriced outputs, the former at national and regional

levels and the latter at forest and planning unit levels.

Most of the research devoted to assigning monetary values to unpriced goods and sevices has been conducted by economists. The concern for value measurement is not unique to economists. Scholars from a broad array of disciplines have addressed this issue. Most noneconomists have not attempted to measure value in monetary terms, however, and some have regarded the attempt to do so as inappropriate. Whatever may be the validity of the position that values cannot or should not be measured in monetary terms, current Forest Service policies and planning procedures either require such monetization outright, or greatly facilitate the planner's analytical task if it can be achieved. For this reason, as well as because economic techniques for assigning monetary values to unpriced goods and services remain relatively unproven and controversial, it is timely to ask whether past research on value elicitation and quantification done outside of economics can enrich and improve available methods for imputing monetary values. The study reported herein had such a goal. Specifically, the research objective was to compare two methods of value elicitation which possessed many common characteristics, yet which were also quite dissimilar in that one was developed within economics and employed a monetary value measure whereas the other was developed outside of economics and did not yield monetary estimates.

The original problem context proposed for the research was

that of evaluating water quality changes which might result from forest recreational activities and related developments. This objective was established for that part of the Eisenhower Consortium program to which this research project was to contribute. Early in the process of formulating the project study plan that objective was shifted to one of developing and comparing recreational values determined by willingness-to-pay and social judgment analysis, defining tradeoffs between competing land uses, and evaluating the results of using the two methods in order to help forest managers choose which method to use. Preliminary investigations disclosed that the water quality impacts of forest recreational activities were insufficiently understood to provide a basis for social evaluation, and that what was known suggested that such impacts were not likely be very important, at least in this region. The focus of the investigation was then shifted to the broader issue of estimating monetary values of forest recreation use in order to facilitate forest land use planning in general.

Yet another change in research objectives occurred as the project progressed. Conceptual inquiry revealed that the economic value elicitation method referred to above as willingness-to-pay analysis, and hereafter termed contingent valuation (CVA), and the psychological value elicitation method of social judgment analysis (SJA) were best thought of as complementary techniques rather than as competitors between which

forest managers were forced to choose. That theme recurs throughout the pages of this report. Therefore, the research strategy of empirical application of the two techniques in a common or similar setting and subsequent comparison of results was abandoned. The inquiry evolved into a conceptual analysis and comparison rather than an empirical one.

The purpose of this research was to compare a direct value elicitation method, social judgment analysis, which was developed by psychologists, to the direct elicitation methods, commonly known as contingent valuation techniques, which have been developed by economists over the past two decades. The research was predicated upon the notion that developments within the two disciplines of economics and psychology might be found to be complementary; that is that economists and psychologists might have something to teach each other about the problem of value elicitation. The basic problem, however, is one which is posed by economics, not by psychology, and therefore the thrust of the report lies in the use of psychological knowledge to improve upon economic methods and reasoning. It should not be difficult to turn this concern around in order to discuss what psychologists might learn from economists in the area of value elicitation. We have generally resisted the temptation to do so. We do observe, however, that economics appears to provide a well-developed framework or perspective within which to conduct value elicitation and correspondingly valuable insights concerning how

the results may be used productively. Psychology offers no such framework, but it does offer a sophisticated methodological approach to value elicitation which is well grounded in the experimental study of individual behavior. It does appear to us that that mutual enrichment is possible between these two disciplines in this particular area, and that improved applications can result from interdisciplinary research.

The balance of this report consists of four sections. The first of these is a conceptual review of the value elicitation problem for unpriced goods and services. This subject has been the focus of several recent comprehensive treatments, e.g., Sinden and Worrell (1979). Consequently, our review addresses only those issues which are of special concern in this research project; it is quite selective. We do not discuss at all, for example, the very difficult, still unsolved, and absolutely crucial problem of going beyond individual subjects to collective or aggregative value assessments, for neither we nor the methods we examine have anything helpful to say on this issue. The second of the sections to follow then turns to the specific similarities and dissimilarities between contingent valuation (CVA) and social judgment analysis (SJA). The third section of the report analyzes implications for forest land use planning and policy analyses of the findings of the preceeding sections. The final section draws conclusions from the analysis in general.

Conceptual Framework

Human decision making requires two quite different types of information. It requires factual or technical information about the environment. Such information is needed to predict the probable consequences of adopting each of the options under consideration. It also requires value information which is needed to predict how desirable those consequences might be. The human environment itself is value-free. It is valued by humans. Values, therefore, are not objective environmental attributes but subjective assessments internal to the valuer.

The way in which a person values his/her environment is termed that person's preference structure, utility function, or value system. It is an intellectual construct used to predict how that person would behave in a choice situation. Preference structures are not observable; only behavior is observable. Preference structures do not explain behavior, in the sense of revealing why people choose as they do, but they should predict what choices people are likely to make.

Value judgments are made by individual human beings. People act together to make collective choices, even as they act singly to make individual choices. They do not make collective value judgments, however. We may use such terms as social welfare function or national interest in ways which are analogous to our use of the terms individual preference structure or utility function, but the procedures by which collective choices are made

are quite different from those by which individual decisions are made. Although the value judgments of individuals underly all collective decisions, the way in which individual's preference structures are considered and aggregated in the collective decision process is a topic which is beyond the scope of the current inquiry. Political processes and economic (market) processes represent two different categories to describe at least some of the more organized ways of employing individual's preferences in the process of making group decisions.

Nevertheless, the preferences of individuals are little more than raw data to the decision maker whose job it is to make public decisions like those posed by RPA and NFMA. Some scholars have attempted to develop procedures for aggregating individual's value judgments in ways which would be at least consistent with social, including political and economic, norms (the theoretical work of Rawls, 1971 has been influential, while that of Anderson, 1981 provides an example of ingenious applied research).

This research report is concerned only with the elicitation of individual's preference functions or values. It leaves to others the crucial questions of whose values are to be elicited and how those values are to be used in making public decisions. It does so because both of the value elicitation methods examined are silent on these questions. It does deal, however, with two other key issues in value elicitation. They are the identification of the factors, attributes, or cues for which values are

sought and the quantitative elicitation of those values.

The Valuation Model

It is not obvious for which factors values should be sought. Forest land use planning requires tradeoffs between such possibly competitive land uses as timber production and recreation. Timber products are bought and sold in markets, and acquire prices when sales occur. The theoretically appropriate factor to value is the satisfaction or utility derived by ultimate consumers from the use of manufactured timber products. If we are willing to make enough assumptions about information availability, market functioning, and human rationality, however, we can conclude that the stumpage prices paid for raw forest products are adequate indicators of ultimate utility to final consumers. No such reasoning is possible in the case of nonmarket-valued outputs such as recreation, because there is no initial sale of product (or if there is, it is at administatively determined prices, which shed no light on the value question). We must start, as before, with the utility or satisfaction derived by ultimate consumers, but then we must deal explicitly with what may be a very long inferential chain to lead us back to something which can be observed and measured, and from which utility can be deduced, and from there on back still further to forest production relationships.

Driver and Brown (1975) provide a behavioral model of forest recreation demand which illustrates the complexity of this

inferential chain. They begin with recreation benefits, which correspond to our use of the concept of utility. These benefits are produced within the individual from the satisfaction derived, in turn, from the recreational activity, including preparation and anticipation before the event and recall after the event. The recreational activity itself is determined by the interaction between the recreationist, including his/her values and factual knowledge, and the environment. The objective of forest land use planning is to shape that environment, subject to the many constraints established both by nature and by human institutions, to best serve the purposes of all forest users.

From a psychological perspective that portion of the inferential chain between final benefit (or even satisfaction) and the recreationist's interaction with the forest environment can be longer and more complex than the model of Driver and Brown suggests. Recreational activity, for example, can produce not only direct satisfaction, as in the contemplation of a scenic vista, but also changes in the subject's physical, cognitive, and affective status, all of which can be direct and indirect sources of utility and disutility.

Economists have recently taken an interest in this inferential chain, following Becker (1975) and Lancaster (1976). Under the rubric of household production theory, this line of inquiry seeks to replace the neoclassical concept that utility is derived directly from the consumption of (marketed) goods and

services with a more sophisticated view that consumers use their own time in combination with goods and services in order to produce "final commodities," which are the real arguments of the utility function. Even this two-stage production model is too simple for some purposes. However, it nicely raises the issue of just what it is that is valued.

Our assignment is to determine the monetary value of something associated with forest recreation activity. The options appear to range from utility itself, at one extreme (more conventionally, to estimate the marginal utility of money) to certain recreation-related characteristics of the forest environment at the other. The former is too abstract and far removed from the subject matter of forest managers' concerns to be useful to them. The latter is more to the point, particularly if the characteristics to be valued are both subject to manipulation by the forest manager and directly competitive (or complementary) with such other characteristics as timber supply. It is exactly these environmental variables which the forest manager can and must trade off against other, monetary valued, forest outputs. It is here that imputation of monetary values is desirable to facilitate the decision maker's task.

The problem, however, is whether these environmental variables are also appropriate foci for the elicitation of the values or preferences of recreationists. Household production theory, the recreation demand model of Driver and Brown, and much

psychological research suggest that they are not. Consumption behavior may be better modeled, in the sense of improved predictive power, by recognizing that environmental variables are inputs into a process, whether or not termed a household production function, by which the individual uses the environment to produce utility. The better that process can be understood and modeled the better the predictions of behavior, including valuing behavior, which can be produced.

An explicit model of the recreationist's judgment policy, household production function, or recreation decision process (depending upon which disciplinary language is used) will permit monetary value assignment to any variable in that model if at least one included variable is monetary (economists call such a variable a numeraire). Formally, then, it makes no difference whether a monetary value is sought from the subject for an environmental variable which is an input to his/her recreation decision process, for the utility which the subject expects to receive from engaging in recreational activity, or for some intervening variable, such as an attribute of the environmental variable, the subject's time, or a change in the subject's physical, cognitive, or affective status which recreational activity might induce. The choice criterion must be sought not in the formal model of the decision process but in the psychological considerations which bear upon the elicitation process. The discussion now turns to that elicitation process.

Specification of the Model's Parameters

Most methods which economists have developed for assigning monetary values to unpriced goods and services are characterized as indirect methods, in the sense that they rely on inference or imputation of the values of the goods or services of interest from observed values of other, but related, variables. Sometimes the observed variables are the market prices of related goods and services, as in hedonic pricing methods. Sometimes they are other observed variables from which monetary implications can be deduced, as in travel cost methods. In any case, they fall within the mainstream economics inclination to make inferences from historical observation rather than from the controlled experimentation favored in most scientific disciplines.

Some value elicitation methods developed within economics are direct methods, in the sense that an attempt has been made to obtain values directly from subjects in more or less controlled experiments. The value sought in each case is the subject's prospective willingness to pay for an additional good or service, or his/her willingness to accept compensation for the loss of a good or service. Although uncommon in economics, these direct methods resemble in many respects the experimental and quasi-experimental methods, of which SJA is one example, which are commonly used in the behavioral sciences.

The great advantage of direct value elicitation methods is that many (not all) factors which might influence the independent

variable can be controlled by the investigator. The method of controlled experimentation has been central to the achievements of many of the natural sciences and some behavioral scientists regard it as essential to similar progress in their disciplines (a contrary position, holding that properly designed statistical analyses of historical data are similarly "scientific" may be found in Wold and Jureen, 1953).

Direct value elicitation techniques may be univariate or multivariate. Univariate techniques are those which elicit values for single cue variables, or for multiple cues singly and separately. Their use requires making the same four assumptions about the individual's utility function which are required in the use of indirect value elicitation techniques. Those assumptions are that utility functions are additive, separable, symmetrical, and homogeneous of degree zero (King and Dyer, 1980). Another requirement is that a monetary or other objective measure of value be used. This requirement limits the practical use of univariate techniques to situations in which the subjects are accustomed to monetary valuation of each included cue.

Multivariate or multiattribute techniques are those which elicit values for multiple cues in combination. They may be further subdivided into *a priori* and *a posteriori* categories (Lord, Deane, and Waterstone, 1979). *A priori* techniques are those which require the subject to specify cue values directly and explicitly, e.g., to divide a hundred points among them (Gum,

Roefs, and Kimball, 1976). A posteriori techniques are those which require the subject to specify the wholistic values of multicue profiles. Statistical techniques are then used to extract the individual cue values (and possibly additional information as well).

Multiattribute methods assume, at least implicitly, that subjects' utility functions are weakly separable, which is to say that the marginal rates of substitution between all elements in a set of cues are independent of the levels of all cues which are not elements of that set. This assumption can be tested by varying the elements in the cue set, however. The additivity, symmetry, and homogeneity assumptions are not required when multiattribute methods are used. Multiattribute methods are thus more robust, in the sense of requiring fewer restrictive assumptions, than are univariate elicitation methods. Their offsetting disadvantage is that they require more data, and are therefore more costly and less practical for large-scale applications.

We have said that univariate direct value elicitation techniques can be used only when the cues are those which subjects are accustomed to valuing in monetary terms. The situation is not much different when multiattribute techniques are used to elicit monetary values for unpriced cues. Two possibilities exist. Subjects can be instructed to estimate the monetary worth of each multicue profile or they can be instructed to assign an

abstact relative value estimate (the usual procedure) to multicue profiles in which one of the cues is money. The former procedure does require that each cue be one which the subject is accustomed to valuing in monetary terms, but in the latter procedure that requirement is weakened somewhat. The subject must be able to trade off at least one of the nonmonetary cues against money, and no cue subset may be weakly separable from any other cue subset (recall that separability is required between the cue set itself and all possible cues which are not elements of the cue set).

Findings

Contingent Valuation

Within economics, techniques used to directly elicit subjects' willingness-to_pay or willingness-to-accept compensation are often called contingent valuation techniques. The simplest of such techniques rely on a direct request to supply a monetary estimate of the value of the good or service of interest. More sophisticated versions employ a bidding game approach, in which the subject is asked to respond to successively increasing (or decreasing) monetary values by stating whether he/she would be willing to pay (or willing to accept) such a price for a stipulated increase (or decrease) in his/her quantity of the good or service of interest. For the puposes of this analysis, these two techniques are considered to be variants of a single method, that of contingent valuation, although it is equally possible to consider them to be different methods. Sinden and Worrell (1979) classify the direct request for an estimate of WTP or WAC as an expedient method and the bidding game as a rigorous method.

Whatever the specific elicitation technique employed in the application of the contingent valuation approach, one common feature is that monetary values are established for one good or service at a time, i.e., the univariate approach is employed. There is no reason in principle why combinations of goods and services could not be presented to the subject in such a survey, thereby adopting a multivariate approach, but this is very rarely

done in practice. If it were to be done, it would be necessary to present a number of such combinations in order to derive from the subject's responses the implicit monetary values of each of the goods and services included.

Another common characteristic of the applications of the contingent valuation approach is that the good or service for which a monetary value is elicited is objectively identifiable. That good or service (most often a public good) may be a recreation user day, a wildlife sighting, an option to visit a wilderness area sometime in the future, the assurance that an endangered species or a unique landscape will be preserved, or any of innumerable similar valued and objectively identifiable goods. Again, this is not a characteristic which is necessary in principle to the application of the contingent valuation approach. It would be possible in principle to elicit the monetary values which subjects attach to such subjective goods as happiness and self-esteem. However, people are not accustomed to placing monetary values on such sujective variables, and it is doubtful, therefore, that the results of such an exercise would be reliable.

Household production theory models consumption behavior in a more complex fashion than does the more usual neoclassical theory in which the consumer is presumed to derive utility directly from the acquisition of goods. In household production theory the consumer is presumed to combine goods with his/her own time in

order to produce "final commodities," which are the arguments of the consumer's utility function. For example, a consumer might be hypothesized to be a producer of good health, using his/her acquisitions of foodstuffs (goods) and his/her time as inputs. Good health is, in turn, one argument of the consumer's utility function.

Contingent valuation techniques would not usually be used by economists in order to estimate the monetary value of good health, although there is nothing in principle to prevent such an application. In fact, the inclination of most economists would probably be to use an indirect valuation approach if given this assignment. Most would probably attempt to infer the value which the subject placed upon his/her health from the expenditures which he/she was observed to make upon foodstuffs known to be conducive to good health and upon other health-related goods and services. Nonetheless, the household production concept has produced an awareness among economists of the probable complexity of the linkages between consumer goods and subjective utility.

Social Judgment Analysis

Social judgment theory has been developed by psychologists in order to understand and improve human judgment and decision making. The theory will not concern us here, but the interested reader is referred to the writings of Brunswick, Tolman, Hammond, and associates for detailed expositions (c.f., Hammond, Stewart, Brehmer, and Steinmann, 1975). This theory has led, in turn, to

the development of techniques for eliciting and analyzing human judgments. These techniques, henceforth referred to as Social Judgment Analysis (SJA), resemble contingent valuation techniques in certain respects, most notably in that both are direct approaches, and differ from it in other respects. We first describe social judgment analysis and then turn to its similarities and dissimilarities to contingent valuation.

Social judgment analysis, which can be used to elicit either judgments of fact or value judgments, involves presentation of a set of randomly generated multicue profiles to the subject and gives him/her the task of estimating the relative value of each such profile. Each profile consists of a stipulated amount or level of each of valued attribute or cue. Subsequent statistical analysis of the subject's responses then produces weights, function forms, and variance or consistency, for the subject's preference or value structure over the listed attributes. The subject's utility function is normally assumed to be additive (the combinatorial principle, in judgment analyst's language), but it is possible to employ a multiplicative combinatorial principle as well.

SJA is, therefore a direct, multiattribute, a posteriori value elicitation technique, as those terms were defined earlier in this report. It shares certain characteristics of the contingent valuation techniques. It also differs from those techniques in both principle and practice.

Similarities Between CVA and SJA

Both CVA and SJA are direct value elicitation methods, which is to say that both obtain value information from the subjects, or "valuers," themselves. This is in contrast to indirect methods, which attempt to infer values from prior behavior. This is the most fundamental of many possible distinctions between value elicitation methods.

Both CVA and SJA, when they are used in applied research, require subjects to respond to hypothetical rather than actual situations. Real rewards and penalties have been offered in methodological research but non-binding decisions generally characterize applied research. This non-binding aspect has been the focus of most of the objections raised by economists to the use of direct value elicitation techniques. Freeman (1979) summarizes those objections under the topics of strategic behavior and accuracy. The possibility of bias due to strategic behavior occurs when CVA is used to assign monetary values to public goods, a common application of the method and one which is central to the concerns of this report. Public goods are those which are not subject to the exclusion principle, which is to say that they cannot be withheld from one user except by withholding them from all users.

In the case of a public good, particularly if there are many potential users, a subject may overstate the value of the good to him/her in the belief that the purpose of the survey is to

determine whether to make the public good available, or he/she may understate its value in the belief that the purpose of the survey is to determine how the costs of making it available are to be distributed. It is possible to design CVA questions in such a manner as to minimize, if not to eliminate, the possibility of strategic behavior, but only at the cost of diminishing the subject's incentive to provide well-considered responses. This, in turn, raises the possibility of inaccurate results.

Both CVA and SJA incorporate rigorous quantification of the cues or attributes which are valued. Quantification is theoretically essential for meaningful results, and is consequently incorporated in all rigorous value elicitation methods. Quantification refers to the scaling of the cues used in the value elicitation exercise. Practitioners of both CVA and SJA strongly advocate the use of ratio, or at least interval, scales for quantifying cue values.

Differences Between CVA and SJA

CVA attempts to elicit preferences for single goods or services, or for multiple goods or services singly and separately. SJA, by contrast, attempts to elicit preferences for multiple attributes or cues jointly. This is a difference in practice. There is no reason in principle why preferences for combinations of goods and services could not be elicited through the use of CVA techniques, although if this were to be done it would be necessary to present a number of such combinations in

order to derive from the subject's responses the implicit monetary values of each of the goods and services included. SJA, by contrast, is intrinsically a multiattribute method.

SJA requires *a posteriori* decomposition of subjects' judgments in order to estimate the values which subjects place upon individual cues. CVA requires no such *a posteriori* analysis because it is not, in practice, a multiattribute method. Decomposition of wholistic value judgments made by the SJA subject for multicue profiles into implied value judgments upon single cues is accomplished through multiple regression analysis. The wholistic judgments are treated as the dependent variable and the cue values as independent variables in the regression analysis. CVA does not employ a statistical procedure for eliciting the WTP or WAC of individual subjects because it relies on a single direct observation for each cue value. In so doing, it provides no opportunity for analyzing the potential variance in such judgments; variance which SJT attributes to ambiguous information and imperfect cognitive abilities.

CVA invariably elicits values in monetary terms; it is designed to do just that. SJA, on the other hand, rarely does so. When SJA is used to elicit value judgments the unit in which value is expressed is normally left unspecified, although a quantitative scale is provided. Subjects are usually requested to assign a relative value, on a scale such as 1 to 20 or -20 to +20 for example, to each multicue profile.

There is no reason in principle why SJA could not be adapted to the purpose of eliciting monetary values for judgment cues. Two means exist for doing so. The first and most obvious adaptation would be to specify the value scale in monetary terms in place of the usual practice of allowing the unit of value to remain unspecified. This would imply moving from an interval scale to a ratio scale, normally a desirable change. However, it would then require an additional and potentially difficult investigative step, that of determining the appropriate value range. That range could be expected to display substantial intersubject variance, thus creating a subsequent analytical problem as well. Yet another consideration is that all of the cues employed would have to be susceptible to monetary valuation by the subjects.

The second means of adapting SJA to the elicitation of monetary values would be to include a monetary cue as one of the independent variables. The dependent variable, relative value of the multicue profile, would be unit-free, and thus interval-scaled. However, the monetary cue would provide a numeraire, permitting transformation of each of the cue units and the abstact value unit of the dependent variable into monetary terms.

In practical terms, CVA is less demanding of research resources and the subject's commitment than is SJA. The latter requires multiple responses in order to permit statistical inference from those responses. CVA does not. Furthermore, the

number of profiles which the subject must evaluate increases more than proportionally to the number of cues when the number of cues exceeds about seven (this has been found to approximate the number of factors which can be considered simultaneously by most subjects). Subjects' cognitive abilities and degrees of commitment place more severe limits upon the use of SJA than upon the use of CVA, although those limits can be exceeded easily in applications of CVA as well.

Some of the most attractive features of SJA, such as the capability to feed back to the subject the parameters of his/her judgment policy almost immediately and to permit reconsideration, come only at the cost of further extending research resource and subject participation requirements.

Implications

The purpose of this research was to examine and compare two direct value elicitation methods, CVA and SJA, and to evaluate their suitability for use in estimating monetary values for unpriced outputs of forest land management. Such monetary values could then be employed in forest management and policy planning, particularly in the formal programming models which now characterize RPA and NFMA analyses within the U. S. Forest Service. CVA and SJA were compared in the preceeding section of this report, but their respective advantages and disadvantages for forestry decision making were not evaluated. That is the subject to which this section of the report is addressed.

Contingent valuation (CVA) has been used repeatedly, both in research and in application, to estimate monetary values for public goods and other unpriced, or nonmarket priced, goods and services. As a result of this extensive experience there are now many researchers and some managerial professionals who are familiar with its procedures and the qualifications which must be considered in using it properly. A research program designed to estimate monetary values for forest recreation opportunities, for example, could be established within the Forest Service without the need for developing new procedures for conducting the research. Such a program could be expected to produce results with at least order of magnitude precision or accuracy. The possibilities for biased estimates due to strategic behavior

could be controlled, but perhaps only at the cost of increased variance due to reduced incentives to provide accurate responses.

Whether the bias and inaccuracy level to be expected in the use of CVA techniques exceeds or is less than that characteristic of indirect techniques, such as the hedonic pricing and travel cost techniques, is unknown. Indirect techniques, although they avoid the problems of strategic behavior bias and inaccuracy due to lack of incentive to respond thoughtfully, entail their own risks of bias and inaccuracy. Theoretical sources of bias include possible violations of the additivity, separability, symmetry, and homogeneity properties typically assumed to characterize the utility function (King and Dyer, 1980). We return to a discussion of these properties in a subsequent section of this report. Brookshire and Crocker (1979) provide additional reasons why values estimated through indirect methods may be biased and inaccurate. They believe direct methods to be superior, even as Freeman (1979) prefers indirect methods. Available research results do not support a definitive judgment in favor of either position.

CVA does hold one undisputed advantage over all indirect methods; it can be applied to those resource values which are not linked to overt consumption or market behavior of any kind. Option value and existence value, for example, cannot be estimated indirectly because they are not so linked. Of course, it is exactly in such applications that the use of direct techniques is

most open to question, because the hypothetical choices to which subjects are required to respond do not resemble choices to which they are accustomed to respond in reality. Questions of bias and accuracy aside, however, direct techniques do produce estimates in such contexts while indirect techniques do not.

Indirect techniques possess a major practical advantage over direct techniques for value elicitation in applied situations. They are usually less expensive to implement because secondary data can often be used, thereby avoiding costly surveys. Even when primary data collection is necessary, as in most applications of the travel cost method, it is likely to be data which do not require personal interviews or, at most, require only simple objective answers, such as place of residence. Furthermore, Office of Management and Budget clearance requirements may effectively preclude the use of direct methods by federal agencies.

The practical disadvantage cited for CVA apply to SJA as well, but with even greater force. SJA techniques are relatively very costly. They require more time and thought from both respondents and interviewers than do CVA techniques on the average, particularly since they require the respondent to evaluate enough value profiles to provide a basis for statistical analysis. Only multiattribute utility analysis (MAUT), a form of decision analysis which requires that subjects make judgments of occurrence probabilities, is more complicated and more demanding

of both subjects and interviewers. MAUT is generally employed in applications in which one or only a few subjects are required to make relatively major decisions because it is so costly. Similarly, SJA probably should be used only in applications in which the number of subjects can be limited to at most a few hundred.

Use of SJA requires knowledgeable analysts and trainers, resources which the Forest Service does not possess and which are in scarce supply elsewhere as well. It would be very difficult to implement an SJA-based program of monetary value estimation as a part of RPA and NFMA data collection even if cost were not a barrier.

These considerations appear to eliminate the possibility that SJA could receive widespread and general application within Forest Service RPA and NFMA decision making, at least for the purpose of deriving estimates of the monetary value of unpriced forest outputs to users of those outputs.

If SJA shares the practical disadvantage of CVA, it does not necessarily shares its other disadvantages. Strategic behavior, while not impossible, is much less likely in SJA than in CVA. Subjects do not directly state the monetary value which they believe (or wish to be thought to believe) is appropriate for a good or service. Instead, they assign wholistic values to a set of multicue profiles. The subject who wished to provide intentionally biased responses concerning the value of a cue

would have to engage in a conscious and complex process of determining the desired cue weight and calculating or estimating the effect of that cue weight on the value of each multicue profile. While certainly not cognitively impossible, this task would require a degree of deliberation and cognitive sophistication well beyond that required to give intentionally biased responses in a CVA context. Most respondents would probably not succeed in doing so.

Inaccuracy (more precisely, high variance) due to lack of incentive to think carefully is as possible in SJA as it is in CVA. However, in CVA there is no way to assess its presence or magnitude. SJA incorporates a built-in mechanism for doing so. The coefficient of multiple regression which can be calculated for each subject reveals the amount of the variance in that subject's estimates of the values of the wholistic multicue profiles which is associated with or explained by variation in the cue values incorporated in those profiles. All of the remaining variance is unexplained. One of the major potential sources of such unexplained variance is random error due to the subject's lack of concentration on the judgment task. Judgment analysts use the value of the regression coefficient as a measure of the internal consistency of the subject's responses. Sometimes the subject is shown the results of the analysis of his/her responses, including their consistency, and given the opportunity to repeat the exercise. Consistency may rise with a repeat performance. In any

case, however, the consistency of the subject's judgments provides a useful indicator, although not an unambiguous measure, of the cognitive effort expended on the judgment task. High consistency is unlikely to be attainable without cognitive diligence, although low consistency can result from a number of factors. Consistency, then, is a useful piece of information, particularly in a research context, for evaluating judgment data.

SJA incorporates other advantages not possessed by CVA. One such advantage is its ability to reveal the function form of a subject's judgment of the value of each cue. The monetary values which CVA yields for each cue (good or service, in this case) are somewhat analogous to the cue weights yielded by SJA. At any particular level of income the CVA monetary value estimates for multiple goods should be proportional to the marginal utility provided by additional amounts of each of those goods. Similarly, the SJA cue weights reveal the relative values, or utilities, derived from marginal increases in the cue variables. SJA provides more flexibility, however. It can also provide function forms for the subject's value judgments on the several cues. CVA incorporates no such procedure for delineating the functional relationship between the cue level and utility. Economic theory does include a deductively derived statement of that relationship (the law of diminishing marginal utility), but CVA does not incorporate, test, or quantitatively specify this proposition. It could be used to do so, in principle, but the

application would be awkward and less elegant than SJA.

SJA also permits the exploration of the interrelationships between cues in the subject's preference function. CVA, in a multicue context, assumes a simple additive relationship. The same additive assumption underlies all economic methods for the indirect estimation of monetary values. Most applications of SJA have also assumed an additive relationship (called the combinatorial principle by judgment analysts), but in SJA that assumption can be tested by determining whether other, non-additive, combinatorial principles provide greater explanatory power. Such a test would be conducted by incorporating interaction terms in the multiple regression equation.

Another advantage of SJA lies in its potential for testing the separability assumption which underlies both most applications of CVA and the use of all indirect methods. As previously stated, strong separability means that the marginal rates of substitution between two goods are independent of the amounts of any and all other goods consumed; whereas weak separability means that the marginal rates of substitution between all elements of a set of goods are independent of the consumption of all goods which are not elements of that set. Indirect monetary value elicitation methods assume at least weak separability. CVA assumes strong separability, although that assumption could be relaxed and even tested. Again, the assumption can be tested less awkwardly and with greater elegance using SJA.

Economic methods for estimating demand curves also assume that utlity functions are homogeneous of degree zero, which is to say that the monetary value which a subject assigns to each good or service increases in direct proportion to the subject's income (there is no money illusion). Indirect methods of monetary value elicitation share this assumption. Direct methods do not depend upon the homogeneity assumption, but neither do they provide a means for testing it. SJA permits such a test. It would be accomplished by including income as one of the cues in the judgment task (recall that this is one of the two possible means of adapting SJA to monetary value elicitation in the first place). The range of variation for the income cue would then be established to permit sufficient variation for an effective test, but not so much variation as to strain the subject's capacity to meaningfully extrapolate. Random generation of cue values for the judgment task would then permit statistical definition of the regression surface. Appropriate partial derivatives of that function would provide tests of the homogeneity assumption.

Conclusions

Forest Service land management and policy planning under RPA and NFMA does not require that monetary values be established for all forest production outputs. However, the analyses which support the decision process can be made more comprehensive and more powerful if credible monetary values can be estimated for unpriced outputs. For example, the linear programming models, such as FORPLAN and DE FORPLAN, which are used for forest planning purposes employ monetary objective functions. Outputs which can be valued in monetary terms can be included in those objective functions. The linear programming algorithm then calculates that combination of inputs and production technologies which maximizes the value of the objective function. The production of monetary valued forest outputs is thereby optimized.

Any outputs which are not valued in monetary terms can enter the analysis only through the specification of constraints, such as the maintenance of a specified quantity of habitat approriate for an endangered plant or animal species or the maintenance of a specified level of visual air quality. The shadow price, or implied monetary value, of each such output can then be calculated through solving the dual of the original linear programming problem. This shadow price, while it does show the economic implication of the specified constraint, cannot be interpreted as a value judgment without making some heroic assumptions about the cognitive process through which the constraint was originally

specified.

The result of incorporating unpriced forest outputs as constraints rather than the arguments of the objective function in forest planning which is based upon linear programming models is that the values (shadow prices) of these outputs are determined by technical personnel or, at best, by decision makers, neither of whom may have useful knowledge about the preference functions of forest users (more likely, such knowledge will be a compound of the particular value systems of experts or decision makers themselves and their inaccurate perceptions of the value preferences of forest users). In any case, it is unlikely that planning and policy decisions made in this way will truly reflect the preferences of all forest users or of citizens in general.

The Forest Service is properly concerned, then, that unpriced forest outputs be accurately valued in monetary terms. If this cannot be accomplished then the whole methodological basis which underlies current forest planning and policy analysis must be called into question and possibly discarded. The focus of this inquiry has been exactly whether such an accomplishment is possible. The findings on this question can be summarized as follows:

1) Available economic methods for eliciting monetary values for unpriced forest outputs can be categorized as either direct or indirect. Each is subject to

conceptual problems which can cause bias or inaccuracy. However, indirect methods are more practical and less expensive for widespread applications of the kind that are called for in Forest Service decision making.

2) Neither direct nor indirect value elicitation methods produce results which can be regarded as better than very rough approximations. Order of magnitude precision is perhaps the best that can be consistently claimed for them. Information no more precise than this is sometimes adequate for decision making. It is certainly better than no information at all. However, in many cases sensitivity analyses will disclose that more precision is highly desirable. This point could be pursued fruitfully through casting a number of current forest planning situations in a decision analysis format and estimating the value which better information might have (value of information analysis is a well-known technique within decision analysis). The results would be helpful to the Forest Service in determining how much to spend in improving value elicitation techniques, and how to spend it.

3) Assuming that improvement of value elicitation techniques is judged to be probably cost-effective, it would seem appropriate to concentrate those efforts on indirect techniques, because they are the most

practical for large-scale applications. This would indicate that research of two kinds should be pursued. First, an increase in the number of convergent validity studies should be considered. Convergent validity studies are those which employ multiple methods on a single problem and compare the results which they produce. There is no objective standard by which to judge those results, but the assumption is made that methods which produce similar results are probably better than those which are more deviant. Direct elicitation techniques, and CVA in particular, should be included along with indirect ones in such convergent validity studies.

4) The second type of value elicitation research which should be pursued is that aimed at testing the realism of the assumptions which underlie the use of both indirect techniques and direct univariate techniques such as CVA. We have earlier noted that these include four assumptions concerning the nature of the subject's utility function; additivity, separability, symmetry, and homogeneity. It is here that Social Judgment Analysis would appear to have much to contribute to Forest Service efforts to produce and use monetary values for unpriced forest outputs. A relatively modest program of research aimed at testing the

assumptions which underly the use of the less costly value elicitation techniques could be accomplished effectively with SJA. It could provide the assurance which is now lacking that such techniques can be used with confidence in major decision making applications or, by revealing their weaknesses, it could provide a sharpened focus for research aimed at their improvement.

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